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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,607	07/12/2001	Yeong-Kwan Kim	249/258	1299

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LEE & STERBA, P.C.
1101 WILSON BOULEVARD
SUITE 2000
ARLINGTON, VA 22209

EXAMINER

THOMAS, TONIAE M

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 10/07/2002

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/902,607

Applicant(s)

KIM ET AL.

Examiner

Toniae M. Thomas

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 August 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-35 is/are pending in the application.
- 4a) Of the above claim(s) 1-15 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 32, 34 and 35 is/are allowed.
- 6) ☒ Claim(s) 16-19, 22, 24-31 and 33 is/are rejected.
- 7) ☒ Claim(s) 20, 21 and 23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Introduction

1. This action is a first Office action on the merits for Application 09/902,607.

Currently, claims 1-35 are pending.

Election/Restrictions

2. Applicant's election without traverse of Group II (claims 16-35) in Paper No. 5 is acknowledged. Claims 1-15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a non-elected invention, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 22, 24-31, and 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 22 and 33, it is not clear whether atomic layer deposition (ALD) is used to form the multi-layer, or just the silicon nitride layer.¹ In claims 25 and 33, it is not clear whether ALD is used to form the multi-layer, or just the silicon oxide layer.²

¹ See claim 22, lines 2-3 and claim 33, lines 4-5.

² See claim 25, lines 2-3 and claim 33, lines 2-3.

The following phrases lack antecedent basis: "the second bubble prevention layer" (claim 24, line 2), "the bit line spacers" (claim 25, line 2), "each gate stack pattern" (claim 26, line 2), and "each bit line stack pattern" (claim 31, line 2). To provide antecedent basis, claims 24 and 25 should depend from claim 23, claim 26 should depend from claim 21, and claim 31 should depend from claim 23.

Claims 27-30 are included in this rejection because they depend from claim 26.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 16-19 and 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu et al. (US 6,177,307 B1) in view of DiSimone et al. (US 6,118,167 B1) and Kim et al. (US 6,391,803 B1).

Tu et al. disclose a method for fabricating a semiconductor device (see figs. 1A-1H and accompanying text). The method comprises: forming a trench 202, 204, 206, 208 in a semiconductor substrate 200 (fig. 1A); and forming a buried insulating layer filled in the trench without a void (fig. 1A and col. 2, lines 11-14).

The gate stack patterns 20, 22, 24 comprise a gate insulating layer of silicon oxide, a first conductive layer of doped polysilicon, a second conductive layer of metal silicide, and a capping layer of silicon nitride (col. 2, lines 20-26).

Tu et al. do not teach forming a liner layer formed of a multi-layer of silicon nitride and silicon oxide on the sidewalls and bottom of the trench by ALD.

DiSimone et al. disclose a method for forming nitride-lined shallow trench isolation (STI) (figs. 4A-4G and accompanying text). The method comprises: forming a liner layer formed of a multi-layer of silicon nitride 411 and silicon oxide 409 on the sidewalls and bottom of the trench (figs. 4B, 4C and col. 4, line 64 – col. 5, line 4); and forming a buried insulating layer 417 filled in the trench without a void (fig. 4G).

Kim et al. discloses forming silicon nitride layer using ALD (col. 3, line 61 – col. 5, line 13), and forming a silicon oxide layer using ALD (col. 5, lines 54-62).

One having ordinary skill in the art would have been motivated to modify Tu et al. using DiSimone et al. and Kim et al. for the following reasons: forming the multi-layer layer liner of silicon oxide and silicon nitride on the sidewalls and bottom of the trench protects the substrate during the deposition and planarization of the buried insulating layer; and using ALD to form the silicon oxide and silicon nitride layers provides thin films having excellent step coverage and excellent thickness control (Kim et al. – col. 2, lines 20-32).

DiSimone et al. do not teach forming the liner layer without breaking vacuum. However, it would have been obvious to one having ordinary skill in the art to form the liner layer without breaking vacuum because ALD is used to form both the silicon oxide and silicon nitride layers.

Allowabl Subject Matter

5. Claims 32, 34, and 35 are allowable. The claims are allowable because the prior art of record does not anticipate, teach or suggest the following limitations recited in claim 32: [1] forming a first bubble prevention layer of a multi-layer of silicon oxide and silicon nitride on the gate spacers and the gate stack patterns by ALD, or [2] forming a second bubble prevention layer of a multi-layer of silicon oxide and silicon nitride on the bit line spacers and the bit line stack patterns by ALD.

6. Claims 20, 21 and 23 are objected to as being dependent upon a rejected base claim, claim 16, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 20 would be allowable if rewritten as discussed above because the prior art of record does not anticipate, teach or suggest a further step of forming an oxide layer on the sidewalls and bottom of the trench prior to forming the liner layer comprising the multi-layer of silicon nitride and silicon oxide. Claims 21 and 23 would be allowable if rewritten as discussed above for the following reason: the prior art of record does not anticipate, teach or suggest forming a first bubble prevention layer of a multi-layer of silicon oxide and silicon nitride on the gate spacers and the gate stack patterns by ALD, as recited in claim 21.

7. Because claim 33 depends an allowable claim, claim 32, it would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

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8. Claims 22, 24, 25, and 31 are objected to as being dependent upon a rejected base claim, and are also rejected under 35 USC §112, 2nd par., as discussed above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (703) 305-7646. The examiner can normally be reached on Monday through Thursday from 8:00 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JMJ

October 1, 2002



CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800